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**Technology-Based Learning:
The Effect of Technology on Learning
Environment, Student Satisfaction and
Performance**

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Technology-Based Learning: The Effects of Technology on Learning Environment, Student Satisfaction and Performance

Virtual education has become a high priority for institutions of higher learning. Over the past decade, a major paradigm shift in education has occurred, with a prominent change toward the expansion of virtual course offerings in universities, also called distance or outreach learning (Alavi & Leidner, 2001). With this shift of paradigm has come a parallel shift of university resources toward the development of better technology-based teaching tools and the expansion of venues for technology-enhanced learning. Distance programs are not a new phenomenon, with correspondence courses, cooperative education, televised delivery, and continuing education programs having a long history in the United States. The difference between these programs and current distance offerings is the influx of new technology and the commitment to resource allocation to ensure these programs are successful. The convergence of communications and computers has created a landscape perfect for the proliferation of virtual learning and the advancement of virtual learning environments.

Much of the research on virtual environments is outside the domain of virtual learning, and includes research on technology-mediated work collaboration (Belanger, Collins & Cheney, 2001), virtual work or telecommuting (Wiesenfeld, Raghuram & Garud, 2001) and virtual organizations (Kasper-Fuehrer & Ashkanasy, 2001). This stream of research is relevant to technology-based learning because virtual students, like virtual workers, must interact in an environment that operates outside of traditional geographic distance, time, and space. In virtual work environments, employees subsequently rely more heavily on their perceptions to signify the organization and to shape their behaviors. Wiesenfeld, et al. (2001) reported that virtual work increases employees isolation and independence. Consequently, virtuality offers unique management issues in terms of trust (Kasper-Fuehrer & Ashkanasy, 2001), control (Wiesenfeld, et al., 1999), and employee adjustment (Raghuram, Garud, Wiesenfeld, Gupta, 2001). Thus far, few empirical studies testing relationships in virtual work environments exist. Unfortunately, there is no dominant unifying theory to lead virtual work research.

For example, with greater application of technology and the virtual expansion of the classroom comes a critical need for understanding how technology affects (and hopefully improves) the learning process. Alavi and Leidner (2001: 2) published a research commentary asking for a greater breadth of research in technology-mediated learning (TML). The authors defined TML as “an environment in which the learner's interactions with learning materials (e.g. readings, assignments, exercises, etc.), peers, and/or instructors are mediated through advanced information technologies (e.g. computing, communication, and data management technologies, and their convergence).” In their commentary, they report a severe need for research because of the drastic lag behind practice, and a lack of rigorous research to guide the development of TML environments. Since little theory exists in TML literature, psychology, education, and organizational behavior have been used as reference disciplines for this study.

The author hopes to advance the literature on TML, by analyzing the relationships between two dispositional traits, internal locus of control and conscientiousness, with self-reported performance and satisfaction in a technology-mediated learning environment. First, I am interested in how technology shapes the learning process. Second, I am interested in the comparison of traditional and virtual students in terms of reported satisfaction and performance. With better understanding of the interaction of TML to the learning process, we can better guide the development of virtual learning programs.

Hypothesized Model and Theory Development

Kim and Schniederjans (2004) conducted a recent study on the role of student personality and grade performance in web-based distance education courses. They used the Wonderlic Personality Characteristics Inventory (PCI) to assess virtual students on the “big five” personality dimensions: agreeableness, extraversion, conscientiousness, stability, and openness. Here, they found all five dimensions of personality to be either highly or moderately significantly related to grade performance, meaning virtual students who were more agreeable, more extraverted, more conscientious, more self-confident and stable, and more open in terms of creative thinking had stronger grade performance than those students who are more introverted, less conscientious, less confident and less open-to-experience.

This study continues on this stream of research, but considers dispositional traits and the subsequent learning outcome comparing students who learn in traditional settings to those students who learn in a distance environment. Unlike Kim and Schniederjans (2004) who considered five personality dimensions, this study considers two key traits: student conscientiousness and internal locus of control (ILOC). While other dispositional traits certainly warrant consideration, the author limited this study to conscientiousness and ILOC because these traits have been consistently supported in the literature in terms of causality with satisfaction and performance (see Rubin, 1993; Barrick & Mount, 1991). As will be explained in detail below, this study assesses the role of technology in the learning environment; ensuring that traits to be tested had consistent causality to these two outcomes was a critical precursor for this study.

Locus of control and conscientiousness

Locus of control (LOC) and conscientiousness are dispositional personality traits. Variations in psychological traits have been linked with variations in satisfaction and performance. Locus of control refers to an individual's understanding and perceived mastery of their environment. This LOC orientation is typically defined on an internal-external continuum. In general, people with an *external* locus of control believe that they have less control over their environment; that events are likely to occur due to luck, chance or because of the power of others. Externals have a reduced need to seek information (Rubin, 1993) and are more dependent on others than internals (Steinfatt, 1987). In general, a person with an *internal* locus of control believes he or she has a mastery of their environment, expects to control situations, and that behaviors will affect outcomes. Internals are more assertive, extroverted, self-directed and powerful (Rubin, 1993; Lefcourt, 1982).

Conscientiousness is one of the five basic personality dimensions or pre-dispositional tendencies. Conscientiousness is defined as the "drive to accomplish assigned tasks and duties to the best of one's ability and to do so within the confines of established procedures and protocols." Conscientious people are "responsible, dependable, competent, punctual, deliberate and respectful of authority" (Huffcutt, Conway, Roth & Stone, 2001).

Differences between Distance and Traditional Students

Given the complexity of learning environments in general, several broad questions are posed: (1) Are certain types of individuals more suited to learning in distance-based, technology-mediated environments; Do distance programs attract certain types of individuals? (2) Are there differences between virtual and traditional students in terms of outcome measures, including student satisfaction with their learning experience and performance? (3) Given these differences, what role does the use of technology to facilitate a learning environment play in shaping student perceptions and situation-specific dispositions?

Definitive answers to each of these broad questions are certainly beyond the scope of this particular study. Instead, this study is focused upon providing initial insight into these important considerations. Specifically, this study is designed to test the key differences between students who rely upon technology as a learning facilitator and those students who learn in a traditional, classroom-based environment. Initial hypothesis development is focused upon studying these differences.

It is problematic to assume that distance and traditional students are fundamentally different in terms of dispositional traits. Certainly, students that are extroverted, introverted, conscientious, and agreeable exist in both types of learning environments. It has been empirically shown that certain dispositions are more likely to lead to student success. For example, Kim and Schniederjans (2004) link personality traits, such as agreeableness, stability and openness to experience, to student success in web-based learning environments.

In terms of time and space, students who learn in a virtual environment have greater control over their learning environment than do traditional students. Distance students often choose when they want to learn and have the greater flexibility of learning in the convenience of their homes or offices. Because of this flexibility and control, it is hypothesized that internals are potentially more likely to enter a distance education program in the first place and are more apt to be comfortable with the virtual nature of a TML environment. Hypothesis 1 reads as follows:

H1: Virtual students will report a higher internal locus of control than traditional students will.

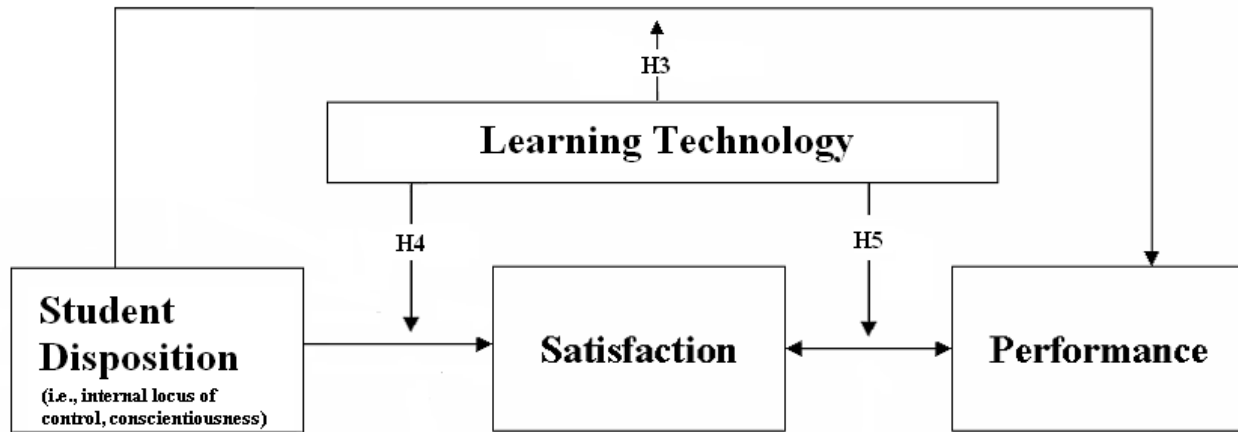
Satisfaction is typically defined in terms of social environments (Argyris, 1964; Likert, 1961). Ostroff (1992: 64) states "satisfaction and positive attitudes can be achieved through maintaining a positive social organizational environment, such as by providing good communication, autonomy, participation and mutual trust." Because virtual or outreach students have less interaction with peers and professors, it is believed that they will lack the social support networks of classroom-based students. It is hypothesized that virtual students will experience a higher degree of isolation and will consequently experience lower levels of satisfaction. Hypothesis 2 reads as follows:

H2: Virtual students will report lower levels of satisfaction than will traditional students.

Hypothesized model

Additionally, this study is focused upon uncovering how technology usage affects the learning process. In studying technology-based learning environments, the role of technology in the learning process must be established up front. One perspective adheres to the assumption that technology will directly affect the learning process. Here, technology is a causal variable with direct impact on the learning process. A competing perspective treats technology as peripheral to the learning process. Poley (1998) explicitly states that distance education is not about technology, but is about teaching and learning. Additionally, Alavi and Leidner (2001) argue that learning technology should be used as a tool to bridge the physical gap between students and their instructors, in a manner that is high quality, affordable, and convenient. Both works treat technology as an instrument to facilitate the learning process, with no direct effects from the technology implied. Consequently, the technology should not have a direct impact on student satisfaction or performance. The hypothesized model for this study adheres to the general assumption that underlie both Alavi and Leidner's (2001) and Poley's (1998) contributions. Here, it is argued that the only causality of information technology will be indirect and via the interaction with the causal variables tested, suggesting that technology will moderate the relationships between a student's disposition, student satisfaction and student performance. Figure 1 details the general model.

Figure 1: Hypothesized Model—Use of technology to facilitate learning will moderate the relationships between student disposition, student satisfaction and student performance.



As can be seen from the hypothesized model, a TML environment should moderate the relationship between each dispositional trait and satisfaction; should moderate the relationship between each dispositional trait and performance; and should moderate the relationship between students' reported satisfaction and performance. Instead of looking at causality among variables, the current study focuses upon the interaction of learning technology (or the absence of) with each of these variables. Each relationship is developed in the following sections.

Relationship of Conscientiousness to Self-reported Satisfaction and Performance

Several studies have found a positive relationship between conscientiousness and satisfaction (Watson, Hubbard & Wiese, 2000; Organ & Lingl, 1995). These authors argued that one or more key personality measures, including the dimension of conscientiousness, bring about satisfaction. Organ and Lingl found that two personality dimensions, agreeableness and conscientiousness, affected both United Kingdom and United States employees' satisfaction levels. Research also shows that conscientiousness was highly correlated with performance (Barrick & Mount, 1991) and was a significant predictor of performance (Mount & Barrick, 1995).

While this study does not test any direct relationships between these variables, it is hypothesized that method of instruction will moderate the relationship between dispositional personality traits and satisfaction with learning environment. Conscientious people are very demanding of themselves and others around them (Organ & Lingl, 1995). It is expected that a conscientious student will have strong demands from his or her learning environment. Consequently, a student who interacts with his or her peers and professors in a virtual context will have exceptional expectations of their virtual learning environment. As stated, with support of Alavi and Leidner's (2001) main argument, the actual technology involved in virtual academic programs is only a tool; therefore, it is our contention that learning environment will not directly affect student performance, but will instead moderate the relationship between a student's inherent conscientiousness and his or her level of satisfaction and performance. Hypotheses 3 reads as follows:

H3: Learning technology will moderate the relationship between conscientiousness and student performance.

Relationship of Locus of Control to Self-reported Satisfaction and Performance

There is a great breadth of research on the relationship between locus of control and satisfaction. For example, Epstein and McPartland (1977) found a positive relationship between student internal locus of control and school satisfaction. Meinert, et al. (1991), on the other hand, found no relationship between locus of control and user's satisfaction in their study of computer use. The relationship between locus of control and performance has also been tested (Onwuegbuzie & Daley, 1998; Wilhite, 1990). Onwuegbuzie and Daley found high correlation between student performance and internal academic locus of control. Students with the best study skills and those students who were judged to have the highest intellectual ability tend to have an internal locus of control. Wilhite, studying the predictors of successful course grades, found locus of control to be a good predictor of final course grades. Judge and Bono (2001) performed a meta-analysis on the relationship of four respondent traits, including locus of control, on job satisfaction and job performance. They found that locus of control was positively related to job satisfaction, and a strong dispositional predictor of job performance.

Once again, Alavi and Leidner's (2001: 6) premise that the "mutual influence of technology features, instructional strategy, and psychological processes...impacts learning outcomes" is relevant to hypothesis development. Adhering to this premise, learning environment will not directly affect student performance or satisfaction. Instead, it is the combined influence and interaction of technological features with student specific psychological characteristics that will affect a student's self-reported performance or satisfaction.

Internal-oriented students are more apt to believe that they have control over their environments than external students do, and are believed to be more motivated than externals (Rubin, 1993; Lefcourt, 1982). Because virtual students learn in a non-traditional environment, with limited peer and professor contact, it is hypothesized that technology will interact to impact how his or her inherent motivation affects satisfaction and performance levels. Also, given that virtual students in this sample report higher levels of internal LOC with significantly lower levels of satisfaction, it is hypothesized that:

H4: Learning technology will moderate the relationship between locus of control and self-reported satisfaction.

Relationship of Self-reported Satisfaction to Performance

Huebner, Ash and Laughlin (2001) defines school satisfaction as "a cognitive-affective evaluation of overall satisfaction with one's school experiences." The literature on school and learning environment satisfaction is very limited, with only a few studies that attempt to identify determinants of school satisfaction. Ainley (1991), for instance, finds that dissatisfaction with school environment is linked with lower school performance among high school students.

The link between job satisfaction and job performance is much more apparent in the literature (Iaffaldano & Muchinsky, 1985; Ostroff, 1992; Judge, Thoresen, Bono & Patton, 2001). Judge, et al. present a meta-analysis of the job satisfaction-job performance relationship. Here, they show that the large breadth of research available is divided in terms of the relationship between these two variables. There is inconsistency in the literature on whether the relationship between these two variables is causal, reciprocal, spurious, moderated by other variables, or not related at all. The results of this meta-analysis reveal that the most common model testing the relationship between satisfaction and performance is via the use of moderation variables.

The final hypothesis addresses how learning environments affect the relationship between student satisfaction level and student performance. The hypothesized moderating relationship between these variables reads as:

H5: Learning technology will moderate the relationship between self-reported satisfaction and self-reported performance.

Methods

Participants

This study uses a Southeastern, AACSB-accredited (American Assembly of Collegiate Schools of Business) university MBA program for the population of analysis. This program was selected as a convenience sample and because it has a strong mix of both classroom-based students and distance students learning tandem. The sample was not limited to a specific course offering, but included all students registered in the MBA program. The difference between the two graduate student groups stemmed from their degree of virtual interaction the use of technology to facilitate this interaction. On-campus students interact in a “traditional” physical setting, to mediate their interactions in and overall learning environments whereas, distance students interact with their peers and professors using technology, primarily using web-based and video-based delivery, to mediate their interactions and overall learning environment.

Surveys were mailed to 224 off-campus students and hand-delivered to 53 on-campus students during a scheduled meeting. Both student groups were asked to complete the survey at their leisure and to return the survey, anonymously, in a postage-paid envelope.

A total of 124 completed surveys were received, representing an overall 45% response rate. The response rate varied for each student group. Thirty-seven on-campus student surveys were received (69% response rate) with 86 off-campus surveys (38% response rate). One survey lacked demographic information and could not be grouped. Due the smaller population of on-campus students, the high response rate from this group was considered critical to ensuring statistical power.

The mean age of respondents was 29.5 years (SD = 6.6) with 6.4 years (SD = 6.3) of post-baccalaureate work experience. Thirty-one percent of respondents were female. The mean number of completed MBA courses were 5.6 (s=4). Table 1 details the mean demographic information for on-campus and off-campus sample groups. It is important to note that, with this sample, off-campus students are generally older with more work and/or military experience, and, on average, have higher graduate GPAs.

Table 1: Descriptive statistics for distance student and traditional student sSamples

	Distance Student Sample	Traditional Classroom Sample
Gender (percent female)	33%	30%
Mean Age	31.7	24.7
Mean Yrs of Work Experience	8.35	1.72
Military background (percent)	30%	0.0%
Graduate GPA	3.5 (sd = .4)	3.3 (sd = .44)

Measures

Conscientiousness. To measure conscientiousness, 12-items were taken from the NEO Five-Factor Inventory (McCrae & Costa, 1987; Costa & McCrae, 1992). The NEO-FFI offers a short-form of 60 questions to measure neuroticism, extroversion, openness to experience, agreeableness, and

conscientiousness. These five factors are often referred to as the "Big Five" (Barrick & Mount, 1991) measures of an individual's personality. Respondents were asked to indicate their agreement with statements concerning negligence, neatness, organization, and discipline. Respondents used a 1 (*strongly disagree*) to a 6 (*strongly agree*) scale to indicate their agreement with statements such as "I strive for excellence in everything that I do." The reliability of this scale was $\alpha = .71$.

Internal Locus of Control. Several externally validated measures of locus of control exist in the applied psychology literature. Palenzuela (1984, 1986, 1988) warns researchers to be aware of the lack of a theoretical link between the locus of control measure used and the underlying construct. Rotter (1975) suggests that locus of control must be used to predict behavior in a specific context. To ensure substantive validity, it was imperative to employ a locus of control measure that evaluates locus of control in an academic context. Two measures of academic-specific locus of control (Trice, 1985; Palenzuela, 1984) were evaluated. Trice's (1985) 28-item Academic Locus of Control scale (ALC) evaluates locus of control on two dimensions, externality and internality. Palenzuela's (1984) 15-item Multidimensional Academic-Specific Locus of Control scale (MASLOC) covers three dimensions: Internality (contingency), Helplessness (non-contingency), and Luck (chance). The MASLOC scale was selected because of its brevity, and high external validity (Eachus & Cassidy, 1997; Palenzuela, 1988). From a substantive context, the MASLOC scale appears better suited to measure academic locus of control in a technology-mediated learning environment.

To measure internal locus of control, fifteen items measuring internality, helplessness, and luck (five items each) were taken from the MASLOC scale. Respondents were asked to indicate their level of agreement or disagreement with statements regarding internality or externality of power within their learning environment. Respondents used a 1 (*strongly disagree*) to a 6 (*strongly agree*) scale to indicate their level of agreement with statements such as "If I want to obtain a good academic record, it is essential that I have good luck." Five items measure the respondent's internality, five items measure helplessness, with five-items measuring luck; these items were combined to generate a single score for each sub-dimension of locus of control. Question 6 was problematic and did not load with the other questions for locus of control; consequently, this question was removed from the scale. Reliabilities for each sub-dimension of LOC are Luck: $\alpha = .68$; Internality: $\alpha = .73$; Helplessness: $\alpha = .76$. The reliability of the combined internal LOC measure was $\alpha = .83$.

Student Learning Environment Satisfaction. To measure satisfaction with learning environment, a four-item scale was adapted from Venkatesh and Vitalari (1992), with "learning environment" replacing "work environment" on each of the four questions. Belanger, Collins and Cheney (2001) used this measure in their study of telecommuter communication. Respondents were asked to rate on a 6-point Likert scale (1=strongly disagree, 6=strongly agree) their degree of satisfaction with their learning environment. Consistent with Belanger, Collins and Cheney (2001), question one was inevitably removed from the scale due to low reliability. The reliability of this scale was $\alpha = .86$.

Student Performance. Student grade point average was used as a measure of student performance. To account for a relatively low variance among graduate student grades, an additional measure to assess performance was used. This five-item self-report measure of student performance was adapted from Becker, Billings, Eveleth, and Gilbert (1996) and Belanger, Collins and Cheney (2001) and fulfills Rice's (1992) qualification for the components of self-reported performance. Rice defines the components of self-reported performance as quality of work, effectiveness, productivity, the ability to obtain information, the ability to make decisions, and having access to others. In particular, this scale was selected because it gives a measure of performance in relation to a specific performance environment. The scale was adapted by replacing "work environment" with "learning environment." Respondents were asked to rate on a 6-point Likert scale (1=strongly disagree, 6=strongly agree) their degree of agreement with statements relating to their performance. Due to low reliability (and consistent with the findings of Belanger, Collins and Cheney) question 3 was removed from the scale. The resultant reliability of this scale was $\alpha = .83$.

Results

Following reliability analysis for each composite measure, correlations were analyzed between all control, independent, dependent, and moderating variables. Correlations for all variable combinations are presented in the Appendix. Please note the variable TML is a dichotomous variable equating to the use of technology to facilitate learning (1=uses technology to facilitate a virtual learning environment; 0=learns in a traditional environment).

TML was significantly correlated with years of work experience (.478), GPA (.288), GMAT (.229), military experience (.239), internal LOC (.224), conscientiousness (.194), satisfaction (-.69) and isolation (.46). The dispositional trait of internal locus of control was significantly correlated with years of work experience (.188), GPA (.288), student performance (.284), and satisfaction (.216). Additionally, satisfaction was significantly correlated with performance (.693). All of these correlations are significant at a level of $p < .05$. Surprisingly, student self-rated performance was not found to be significantly correlated with GPA or GMAT. It is possible that individual students could define personal performance differently. While one student may consider receiving an A-average as a measure of excellent performance, another may consider a B-average as excellent performance. Two additional variables are included for reference in the correlation matrix: student productivity and feelings of isolation. While these variables are not formally tested, the author felt they merited inclusion for potential discussion.

As recommended by Neter, et al. (1996), the differences in means of the two student groups on internal LOC and satisfaction (Hypotheses 1 and 2) were tested using independent sample t-tests and by performing confidence intervals around the differences of student sample mean groups. Table 2 details the comparison between both population means.

The first hypothesis states that virtual students will report higher internal LOC than will traditional students. A directional independent sample t-test was performed to test whether the mean LOC score for on-campus students was lower than the traditional student group. This test revealed significant results indicating preliminary support for this hypothesis.

Because we are comparing two different population means, constant error variance was tested for using Levene's test of variance equality. Levene's test for equality of variances indicates a low F-statistic for internal locus of control, indicating that equal variances between the two student types can be assumed. A 95% confidence interval around the mean difference of the two populations lends support to the first hypothesis. We can be 95% confident that the mean internal locus of control score for virtual students is between .082 and .339 scale points higher than the mean score for traditional students, indicating that with this sample, distance students are more internally-control oriented.

Table 2: Distance students are found to report a higher internal locus of control and lower levels of satisfaction than their traditional classroom-based student counterparts.

	Student Type	mean	sd	t-test for Equality of Means			Levene's Test for Equality of Variances		95% confidence interval of the difference	
				t	sig.	mean diff	F	sig.	lower bound	upper bound
Internal LOC	Traditional	4.9	0.44	2.52	.013	.21	1.46	0.23*	0.08	0.34
	Distance	4.69	0.38							
Satisfaction	Traditional	3.1	0.95	-11.55	.000	-1.81	4.57	0.04**	1.55	2.07
	Distance	4.91	0.72							

*not significant; variances are equal

**significant; variances not equal

The second hypothesis states that virtual students will report lower levels of satisfaction than will traditional students. A directional independent sample t-test was performed to test the difference of the mean satisfaction scores for on-campus students and traditional students. This test revealed significant results and lends preliminary support for the second hypothesis. Levene's test for equality of variances generates a high F-statistic for satisfaction, indicating that equal variances between the two student types cannot be assumed. Controlling for non-constant variance, a 95% confidence interval about the mean difference was constructed. A 95% confidence interval around the mean difference of the two populations lends support to this hypothesis. We can be 95% confident that the mean satisfaction score for virtual students is between 1.55 and 2.07 scale points lower than the mean score for traditional students, indicating that traditional students are more satisfied with their learning environment than distance students.

As recommended by Baron and Kenny (1986), the moderating effects of student type on the relationships between personal characteristics and student satisfaction/performance were tested using hierarchical (OLS) regression. The first step involves regressing the control variables on performance (using both self-report and grade point average as measures of performance); then regressing control variables on student satisfaction. The control variables for this study are: student gender, GMAT, years of work experience, and military experience. Student age was omitted from the control variable list because it is almost perfectly correlated with years of work experience (.924), and years of work experience was found to be a better predictor. None of the control variables were found to be significant predictors of self-reported performance, with only GMAT found to be a significant, albeit weak, predictor of GPA ($\beta = .002$, $p = .001$). This simplistic model explained 10.4% of the variance in GPA. Years of work and military experience were both significant predictors of student satisfaction ($\beta = -.07$, $p < .001$; and $\beta = -.469$, $p = .054$ respectively). This model explained 15% of the total variance in satisfaction.

Hypotheses 3 and 4 suggested that student type will moderate the relationship between conscientiousness and performance, and with locus of control and satisfaction. Additionally, hypothesis 5 suggested that student type will moderate the relationship between student satisfaction and performance. To test these hypotheses, separate hierarchical regressions were developed using the methodology of Baron & Kenny (1986). First, the continuous exogenous variables were centered to ensure multicollinearity was controlled for, with each variable added to the regression model (step 1). Next, the

moderator variable, TML, was added to the model (step 2). Finally, the TML-interaction term was added to the model (step 3). Tables 3-6 detail the hierarchical regressions.

Hypothesis 3 (see table 3) suggested that TML environment would moderate the relationship between conscientiousness and student performance. Here, the main effect of conscientiousness and the interaction term failed to yield significant results. Only TML was found to be a significant contributor. According to Baron and Kenny (1986) the main effects, the proposed moderator and the interaction must all be significant predictors to show moderating effects. Consequently, we are unable to find support for this hypothesis given this sample of students.

Table 3: Use of technology to facilitate learning was not found to affect the relationship between student conscientiousness and student performance.

Dependent: Performance	Step 1		Step 2		Step 3	
	β	T	β	T	β	t
Independent variables:	(Std.)		(Std.)		(Std.)	
Conscientiousness	0.04	0.42	0.071	0.77	0.08	0.7
TML			0.17	1.84*	0.17	1.79*
Conscien*TML					-0.01	-0.13
R-square (adj)	-.007		0.013		0.004	
F-value	0.176		1.78		1.18	

*p<.10

Hypothesis 4 (see table 4) suggested that student type would moderate the relationship between locus of control and student satisfaction. Here, the main effect of internal LOC was found to be significant ($\beta = .213$, $p < .05$); whereas, TML and the interaction between locus of control and TML failed to generate significant results. Consequently, we are unable to find support for the fourth hypothesis.

Table 4: The use of technology to facilitate learning was not found to affect the relationship between student's degree of internal control and their level of satisfaction with their learning experience.

Dependent: Satisfaction	Step 1		Step 2		Step 3	
	β	T	β	t	β	t
Independent variables:	(Std.)		(Std.)		(Std.)	
Military Experience	.015	.164	.038	.403	.037	.393
Years of Work Experience	-.099	-1.083	-.057	-.541	-.058	-.553
Internal LOC	.233	2.571*	0.244	2.656**	.213	2.026*
TML			-.086	-.792	-.1	-.896
LOC*TML					.067	.62
R-square (adj)	.032		.029		.024	
F-value	2.358		1.920		1.605	

*p<.05, **p< .01

Hypothesis 5 (see table 5) suggested that student type would moderate the relationship between satisfaction and performance. Here, the main effect of satisfaction was found to be significant ($\beta = .77, p < .01$). The direct effect of MBA type and the interaction term were both found to be significant as well ($\beta = .13, p < .05$) and ($\beta = -.157, p < .05$). According to Baron and Kenny (1986), the significant direct and interaction effects of each of these variables on performance lend support to this hypothesis. Student type is found to affect the relationship between reported satisfaction and performance. The combined R-square for these three variables is .501, indicating that 50.1% of the variance in student performance is explained by the direct effects of general satisfaction and MBA type, and by the interaction of general satisfaction and MBA type.

Table 5: Hierarchical regression results—Support for Hypothesis 5. Use of technology has a significant effect on the relationship between student satisfaction and performance.

Dependent: Performance	Step 1		Step 2		Step 3	
	β (Std.)	t	β (Std.)	t	β (Std.)	t
Independent variables:						
Satisfaction	0.693	10.575*	0.687	10.58*	0.52	10.33*
TML			0.12	1.85**	0.16	1.98*
Satisfaction*TML					-0.21	-2.12*
R-square (adj)	.476		.486		.501	
F-value	111.84		58.76		41.8	
y=performance						

*p < .05, **p < .1

Discussion

This study was designed to test the moderating relationship of technology-based learning environments on dispositional personality traits, student satisfaction, and student performance. The most practical contribution of this study was to reveal, in this sample, learning environment was found to moderate the relationship between student satisfaction and student performance. The satisfaction-performance permutation has been studied heavily in organizational research, with general agreement that the two are positively correlated. Thus far, the satisfaction-performance relationship has not been studied in the context of technology-based learning environments. The link between satisfaction and performance is very important for business schools offering virtual course offerings and for corporations offering virtual learning programs. Distance programs must satisfy their student constituents while maintaining academic standards and performance. This presents an unusual paradox for distance educators, as often these two strategies compete. A university could err in one direction and exclusively align with the student constituency or err in the other direction to align with university standards that have been created under a traditional classroom-based learning paradigm. It is hoped that some middle ground could be attained to satisfy both requirements and to, eventually, attain success along both dimensions. This study, as any singular study, does not solve this paradox; however, it does provide definite insight into virtual learning environments that will hopefully set the foundation for future research.

Another noteworthy aspect of this study is that student satisfaction levels were found to be significantly lower for virtual students than for traditional classroom-based students. Because satisfaction is typically defined in terms of interactions with others, this finding is not surprising, but very important nonetheless. This is important for distance educators in a number of ways. First, it appears that low satisfaction may be linked to feelings of isolation. This study asked a series of questions of students on perceptions of isolation. While these questions were not designed to comprise a testable scale for isolation (albeit, statements loaded together well; $\alpha = .90$), the virtual students in this sample reported very high levels of isolation, including isolation from other students and isolation from their instructors. Advanced technologies are giving virtual students greater access to their peers, but a lack of physical interaction can be problematic, particularly for people who are used to learning in a physical environment. Second, when measuring satisfaction for virtual students, maybe the satisfaction scale should be defined in terms of expectation rather than interactions with others. Most virtual students have full-time jobs, families, and other priorities. These students may not expect to interact with their peers in an academic setting, and therefore, may not define their personal satisfaction in terms of this interaction. It appears reasonable to assume to a student can be satisfied with their school environment in terms of their personal expectations from that environment (e.g. enhanced knowledge, flexibility of schedule), yet still feel a sense of isolation. Academicians need to be aware of the inherent differences between (and subsequent expectations of) traditional students and virtual students. Future research should investigate these differences.

This study found significant differences between the two groups in terms of internal locus of control. Virtual students reported significantly higher levels of internal locus of control. I contend that virtual students report more internal power because they have control over their learning environment in terms of flexibility of schedule and geography. A virtual student can interact at their convenience; traditional classroom-based students must adhere to a lecture schedule confined to a university campus classroom. Piccoli, Ahmad and Ives (2001) and Ahmad (1999), in their studies of the effectiveness of virtual learning environments, found virtual students to have higher self-efficacy and lower satisfaction than traditional students. Their observations are consistent with these findings; it is safe to assert that virtual students are different from traditional classroom-based students in fundamental ways.

Limitations and Future Research

The current study has several limitations. Unfortunately, with the overall MBA population considered, there were differences in demography between virtual and traditional students. Outreach students were older, with more work experience. Consequently, student type had a high correlation with age and work experience. Using all of these variables to control for variance would threaten inferences from the sample to the general population of MBA students. A sample with a more closely matched demography between traditional student and virtual students would have allowed greater statistical control.

Another limitation of this study stems from the fact that performance, satisfaction and productivity were gathered using self-report measures. Granted, student GPA was used as an objective measure for performance. Interestingly, the correlation between GPA and self-rated performance was not significant. The subjective measures used for this study appear reliable; however, the use of multiple respondents would help minimize any problems with common-method bias. For example, the use of professors to rate student performance (beyond GPA), while subjective, would give a more complete assessment of student performance; this would be especially valid if the independent assessment were used in conjunction with students' self-evaluation of their performance.

Another limitation is that this study used one graduate business program in one university as the population of interest. A stronger research design would include several university programs with different types of virtual course offerings. In re-designing this study, it would be helpful to be able to expand learning environment in terms of Internet courses, video courses, and courses by discipline (e.g. business, engineering, etc.) across several universities.

Future research should consider these limitations, but should also explore other variables that would effect a technology-mediated learning environment. This study used two measures of personality and dispositional traits: conscientiousness and internal locus of control. Other potential traits worth consideration are the remaining "Big Five": agreeableness, extroversion, neuroticism, and openness to experience.

The current study approaches the differences between traditional students and virtual students at only one point in time. A longitudinal study design, looking at virtual students with more and less experience with virtual environments should provide additional insight. Students, over time, develop learning strategies. The current study collected respondent information on number of courses taken; future research designs will consider this variable as a proxy for student tenure. The purpose here will be to test whether dispositional traits and levels of satisfaction differ for virtual students with a short tenure versus virtual students with longer tenure. As experience levels with virtual learning environments increase, it is expected that students will develop an enhanced comfort level and will develop better strategies to handle inconsistencies in their learning environments.

Appendix

Correlation Matrix

	Gendr	YrsWk	GPA	GMAT	Miltry	ILOC	Consc	Perfor	Satisf	Produc	Isolatn
TML	.028	.478**	.288**	.229*	.239**	.224*	.194*	-.16 ⁿ	-.69**	.109	.46**
Gender	--	.119	.048	.106	-.26**	.104	.035	-.065	.069	.073	-.153 ⁿ
YrsWk		--	.159 ⁿ	.016	-.072	.188*	.185*	-.128	-.35**	.006	.252**
GPA			--	.323**	.165 ⁿ	.288**	.164 ⁿ	.061	-.196	.127	.055
GMAT				--	.052	.103	-.066	-.105	-.132	.154	.041
Military					--	.026	.153 ⁿ	-.016	-.138	-.038	.129
ILOC						--	.058	.284**	.216*	.165 ⁿ	.036
Conscie							--	.038	.019	.097	-.043
Perfor								--	.693**	.642**	-.123
Satisfac									--	.624**	.029
Prodtv										--	-.61**
Age		.924**									

ⁿcorrelation significant (2-tailed) at p<.10

*correlation significant (2-tailed) at p<.05; bolded

**correlation significant (2-tailed) at p<.01; bolded

References

- Ahmad, R. (1999). *Effectiveness of web-based virtual learning environments in business education: focusing on basic skills training for information technology*. Unpublished doctoral dissertation. Baton Rouge, LA: Louisiana State University.
- Ainley, J. (1991). High school factors that influence students to remain in school. *Journal of Educational Research*, 85, 69-80.
- Alavi, M. & D. E. Leidner (2001). Research commentary: technology-mediated learning—a call for greater depth and breadth of research. *Information Systems Research*, 12, 1-10.
- Argyris, C. (1964). *Integrating the individual and the organization*. New York: Wiley.
- Baron, R. M. & D. A. Kenny (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.
- Barrick, M. R. & M. K. Mount (1991). The big five personality dimensions and job performance—a meta-analysis. *Personnel Psychology*, 44, 1-25.
- Becker, T. E., R. S. Billings, D. M. Eveleth, & N. L. Gilbert (1996). Foci and bases of employee commitment: implications for job performance. *Academy of Management Journal*, 39, 464-482.
- Belanger, F., R. W. Collins, & P. H. Cheney (2001). Technology requirements and work group communication for telecommuters. *Information Systems Research*, 12, 155-176.
- Costa, P. T., & McCrae, R. R. (1992). *Revised NEO personality inventory (NEO-PI-R) and NEO five-factor inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources, Inc.
- Eachus, P. & S. Cassidy (1997). The health student academic locus of control scale. *Perceptual and Motor Skills*, 85, 994.
- Epstein, J. & J. M. McPartland (1977). *The quality of school life scale*. Boston: Houghton Mifflin.
- Huebner, E. S., C. Ash, & J. E. Laughlin (2001). Life experiences, locus of control, and school satisfaction in adolescence. *Social Indicators Research*, 55, 167-183.
- Huffcut, A. I., J. M. Conway, P. L. Roth, & N. J. Stone (2001). Identification and meta-analytic assessment of psychological constructs measured in employment interviews. *Journal of Applied Psychology*, 86, 897-913.
- Iaffaldano, M. T. & P. M. Muchinsky (1985). Job satisfaction and job performance: a meta-analysis. *Psychological Bulletin*, 97, 251-273.
- Judge, T. A. & J. E. Bono (2001). Relationship of core self-evaluation traits—self-esteem, generalized self-efficacy, locus of control, and emotional stability—with job satisfaction and job performance. *Journal of Applied Psychology*, 86, 80-92.
- Judge, T. A., C. J. Thoresen, J. E. Bono, & G. K. Patton (2001). The job satisfaction—job performance relationship, a qualitative and quantitative review. *Psychological Bulletin*, 127, 376-407.
- Kasper-Fuehrer, E. C. & N. M. Ashkanasy (2001). Communicating trustworthiness and building trust in interorganizational virtual organizations. *Journal of Management*, 27, 235-254.
- Kim, E. B. & M. J. Schniederjans (2004). The role of personality in web-based distance education courses. *Communications of the ACM*, 47 (3), 95-98.
- Lefcourt, H. M. (1982). *Locus of control: current trends in theory and research*. New Jersey: Erlbaum.

- Likert, R. L. (1961). *The human organization*. New York: McGraw-Hill.
- McCrae, R. R. & P. T. Costa, Jr. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, 52, 81-91.
- Mount, M. K. & M. R. Barrick (1995). The big five personality dimensions: implications for research and practice in human resources management. *Research in Personnel and Human Resources Management*, 13, 153-200.
- Neter, J., M. H. Kutner, C. J. Nachtsheim, & W. Wasserman (1996). *Applied linear statistical models*, 4th ed. Boston: WCB/McGraw-Hill.
- Onwuegbuzie, A. J., & C. E. Daley (1998). Study skills of undergraduates as a function of academic locus of control, self-perception, and social interdependence. *Psychological Reports*, 83, 595-599.
- Organ, D. W., & Lingl, A. (1995). Personality, satisfaction, and organizational citizenship behavior. *Journal of Social Psychology*, 135, 339-350
- Ostroff, C. (1992). The relationship between satisfaction, attitudes, and performance: an organizational level analysis. *Journal of Applied Psychology*, 77, 963-974.
- Palenzuela, D. L. (1984). Critical evaluation of locus of control: towards a reconceptualization of the construct and its measurement. *Psychological Report*, 54, 683-709.
- Palenzuela, D. L. (1986). A literature review of some problems and misconceptions related to locus of control, learned helplessness and self-efficacy. *Social Behavior. Sci. Docums*, 16, p11.
- Palenzuela, D. L. (1988). Refining the theory and measurement of expectancy of internal vs. external control of reinforcement. *Person. Individ. Differences*, 9, 607-629.
- Piccoli, G., R. Ahmad, & B. Ives (2001). Web-based virtual learning environments: a research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS Quarterly*, 25, 401-426.
- Poley, J. K. (1998). Distance education for american universities and the world. *American Journal of Agricultural Economics*, 80, 973-979.
- Raghuram, S., R. Garud, B. Wiesenfeld, & V. Gupta (2001). Factors contributing to virtual work adjustment. *Journal of Management*, 27, 383-405.
- Rice, R. E. (1992). Task analyzability, use of new media, and effectiveness: a multi-site exploration of media richness. *Organization Science*, 3, 475-500.
- Rotter, J. B. (1975). Some problems and misconceptions related to the construct of internal vs. external control of reinforcement. *Journal of Consulting and Clinical Psychology*, 48, 56-67.
- Rubin, A. M. (1993). The effects of locus of control on communication motivation, anxiety, and satisfaction. *Communication Quarterly*, 41, 161-171.
- Steinfatt, T. M. (1987). Personality and communication: classical approaches, In J. C. McCroskey and J. A. Daly (editors), *Personality and Interpersonal Communication* (42-126). Newbury Park, CA: Sage.
- Trice, A. D. (1985). An academic locus of control scale for college students. *Perceptual and Motor Skills*, 61, 1043-1046.
- Venkatesh, A. & N. P. Vitalari (1992). An emerging distributed work arrangement: an investigation of computer-based supplemental work at home. *Management Science*, 38, 1687-1706.

- Watson, D., B. Hubbard, & D. Wiese (2000). General traits of personality and affectivity as predictors of satisfaction in intimate relationships: evidence from self- and partner-ratings. *Journal of Personality*, 68, 413-450.
- Wiesenfeld, B. M., S. Raghuram, & R. Garud (1999). Managers in a virtual context: the experience of self-threat and its effects on virtual work organizations, In C. L. Cooper, & D. Rousseau, *Trends in Organizational Behavior*, 6, 31-34.
- Wiesenfeld, B. M., S. Raghuram, & R. Garud (2001). Organizational identification among virtual workers: the role of need for affiliation and perceived work-based social support. *Journal of Management*, 27, 213-229.
- Wilhite, S. C. (1990). Self-efficacy, locus of control, self-assessment of memory ability, and study activities as predictors of college course achievement. *Journal of Educational Psychology*, 82, 696-700.